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In the light of these facts the sufferers' symptoms are readily explained. Flue gases contain, and especially when combustion is incomplete, considerable amounts of sulphurous oxide and carbon monoxide, both distinctly poisonous gases. Furnace gas was common in this house and often very strong—so that the eyes watered and an appreciable effect could be felt in the throat, symptoms at once suggestive of sulphur. The rapid tarnishing of all silver objects was a further indication of the presence of this substance. For the most serious symptoms, however, the responsibility must be thrown on carbon monoxide. The poisonous nature of this gas is too well known to require comment, and sensations of oppression and other mental disturbance are typical of the more acute poisonings, while anæmia, malnutrition, loss of psychic powers and diminished vigor are characteristic of the chronic condition. That the trouble was most aggravated on cold nights—when windows were closed and ventilation poorest, and at the top of the house, is consistent with the furnace explanation. It seems probable that the belief in walking spirits was nourished by real noises coming from an adjoining house. Any such noises would, of course, be likely to be exaggerated in the minds of persons awakened in the night while suffering from carbon monoxide poisoning.

The hygienic lessons are patent. Here is a clear case of thoroughly serious poisoning which might have had at any time a fatal result, and all due to a defective hot-air furnace. This apparatus, often praised for its ventilating effect and probably with justice when in sound condition and properly operated, may evidently become a distinct menace to health. And may not there be similar cases of a milder order, such as escape detection while still causing slight poisoning? Emphasis is also thrown on to the entire question of the possible dangers from flue gases. Brick sewers have been found to be sometimes permeable to illuminating gas; may not these poisonous flue gases sometimes escape into houses through porous or leaky chimneys?

Slight leaks of illuminating gas have often been suggested as a cause of headaches and anæmias of obscure origin; perhaps we should look to leaky furnaces and flue gases for similar effects.

This case should also be of interest to experimental psychologists and investigators of psychic and spiritualistic manifestations, since the reputation which this house was gaining as being haunted apparently arose in large measure from genuine sensations of apparitions and the like, induced by the breathing during sleep of a tainted atmosphere.

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SCIENTIFIC BOOKS

Das Erdöl. Seine Physik, Chemie, Geologie, Technologie, Und sein Wirthschaftsbetrieb. In fünf Bänden. Herausgegeben von C. ENGLER und H. v. HOEFER. Leipzig, verlag von S. Hirzel. 1912.

With the vanishing supply of natural gas, and the diminishing output of the world's stock of light petroleum, this work appears at an opportune moment. The first volume edited by Dr. Engler under the title "Die Chemie und Physik des Erdöls," and just issued, contains 855 pages with full index, and 18 large plates, the latter giving complete analyses and optical activity of petroleum from the principal fields.

The scope of this work and its comprehensive magnitude as indicated by its title and fully substantiated by the first volume, promises the most thorough and complete compilation on petroleum and its products that has ever appeared. It is fortunate that its preparation was undertaken by two such well-known workers in this field. The name of Dr. Engler especially is familiar to every one who is interested in petroleum.

Since the comprehensive report on petroleum by Peckham, to the United States Geological Survey,¹ the great accumulation of lit-

¹Report on the Production, Technology and Uses of Petroleum and its Products, Government Printing Office, 1885.

erature on petroleum has been partly summarized by Redwood,² by Richardson³ and by Clarke.⁴ It was evidently the plan of the authors of "Das Erdöl" to include all that is known concerning petroleum, and one does not proceed far in the perusal of this volume to be convinced that their object will be well attained. It is safe to assert that this work will be found readily accessible for convenient consultation by the investigator, experimenter and refiner, for it will be an indispensable aid to every one interested in this subject.

This volume is devoted to the varieties of bitumen as a generic term for solids and liquids, and to natural gas, their composition, genetics, occurrence, chemical and physical properties, optical characters, heats of combustion, fractional distillation and lubrication. But much the larger space is devoted to the composition of petroleum and its products, with a complete review of the series of hydrocarbons that have been found in petroleum, and the structural relations of the various series on the basis of the most recent classification of the hydrocarbons.

There is a full discussion of all investigations of petroleum from the beginning, and large space is given to the work on American petroleum. The identity of the naphthenes first discovered by Markownikow in Russian petroleum with the same constituents in American petroleum, and with the more recently synthetically prepared cyclo-hydrocarbons, is fully set forth.

It is gratifying to observe that the proof of the absence in any appreciable qualities of ethylene hydrocarbons, especially from American petroleum, is comprehensively presented, for the erroneous statements on this subject in all works on petroleum have been grossly misleading. An interesting résumé is given of the facts and theories relating to the natural formation of petroleum from a chemical

point of view. The behavior of petroleum and its products towards reagents, the action of atmospheric agencies, oxygen and ozone, as well as light, are critically considered.

The complete description of crude petroleum from all well-known fields, including its composition and properties, will be serviceable to the prospector and the refiner. Pyrogenic decomposition under various conditions, with what is known to the refiner as cracking, receives careful attention, as does also such subjects as absorption, capillarity, conditions and limits of explosion, and physiological effects. Considerable space is devoted to lubrication and the efficiency of lubricants. The theory of viscosity and the laws and practical operation of frictional testing machines are presented, with comprehensive tables and ordinate diagrams of the relative and absolute viscosity of the hydrocarbons, both paraffine and aromatic.

Reference is made to the lack of efficiency of dry lubricants and attention is called to the great advantage of a combination of an oil lubricant with graphite in such form that it reduces very materially the coefficient of friction by saturating the bearing with graphite, and at the same time forming a coherent film. It is explained that the difficulty of obtaining graphite in a sufficiently fine condition has been overcome by the colloidal graphite recently discovered by Dr. Edw. G. Acheson which is used in the form of oildag, a suspension of colloidal graphite in a suitable oil or in the form of aquadag, a suspension in water. Diagrams and results of frictional tests on the Carpenter machine are presented, from which the following interesting conclusions are translated.

These experiments confirm also the theory that a proper use of the combined oil-graphite lubricant is in high degree profitable. Besides the reduction of the coefficient of friction which is important from an economical point of view, a material saving in wear of bearing surfaces and of the lubricant required are other essential features in reducing the operating cost. Then, too, the factor of safety in operating is essentially larger and the danger of overloading much less than with lubricants containing no oildag. These

²"Petroleum and its Products."

³"The Modern Asphalt Pavement," J. Wiley & Sons.

⁴"Data of Geo-chemistry," U. S. Geological Survey, 1908.

factors should be of especial importance in the lubrication of motors, flying-machines, automobiles and similar machines.

The work is presented in regard to paper and printing with the characteristic skill and care of the German publisher, and with the patient thoughtfulness on the part of authors and publisher that we are led to expect in German publications.

CHARLES F. MABERY

Applied Biology. An elementary text-book and laboratory guide. By MAURICE A. BIGELOW, Ph.D., Professor of Biology in Teachers College, Columbia University, and ANNA N. BIGELOW, Teacher of High School Biology. 8vo. Pp. xii + 583. New York, The Macmillan Company. 1911. \$1.40 net.

Teacher's Manual of Biology. A handbook to accompany the preceding. By MAURICE A. BIGELOW, Ph.D. 8vo. Pp. viii + 113. New York, The Macmillan Company. 1912.

Readers of SCIENCE have sometimes been entertained by bursts of eloquent disapproval of all courses in general biology. Certain noted botanists especially have been wont to speak of such courses as impossible, decadent, reprehensible; as maladies of a peculiar American epidemic, that has, happily, long since run its course. Their ills have been solemnly charged against presumptuous zoologists who have rushed in where modest botanists fear to tread. Fie on any one who would teach about plants and animals in the same course!

This protest has been loud—perhaps a bit too loud; for certain it is that courses in general biology were never so widespread as at the present time, nor were there ever so many new text-books offered for such courses, not only in America, but in Germany and France as well. Perhaps the reason lies in a permanent educational need, which such courses fulfill. There are those who have tried to test the matter by scientific methods who think so.

Among the many new books offered in this field is an important one by the Bigelows for secondary schools. Its title is "Applied Biology," but, fortunately, the applied part of it is mostly in the title. It would be an important book, if for no other reason, because

it represents a great deal of honest effort on the part of competent teachers of extensive and varied experience, to put together into one consistent course what they deem best of all that they have tried. One does not need to be committed wholly to its plan in order to agree that it has been carefully laid out, and based on long experience and good judgment.

It is a conservative book. It begins with a chapter on definitions and another on the distinctive characteristics of living things (22 pages). Then follow chapters on the frog and the bean plant, these two types serving as an introduction to animal and plant biology respectively (122 pages). Then follow the more customary series of plant and animal types, the plants in descending, the animals in ascending series (300 pages), leading to a concluding part devoted to the consideration of the principles of biology as applied to human structure and life (118 pages). In all this there is much careful culling of both subject matter and methods: and a well-balanced indoor course for city schools is the result.

The biology taught is distinctly that of the laboratory—not of the outdoors. While there are here and there hints of the existence of outdoor biological phenomena, there is no plan provided for the study of them.

The technical terms used are few, but adequate. One notes almost with surprise how great is the gain resulting from the omission of most of the rubbish of terminology that encumbers the average high-school text. Of more doubtful value is the relegation of most of the laboratory work to demonstration by the teacher. Though this saves time and yields fewer failures of individual experiments, one may well doubt whether the pupil will learn, by handling pen and paper and recording results, what the handling of the things would teach him.

The illustrations are old—some of them so old that the original sources appear to have been lost. The authors seem to think that "well-known figures from standard biological works are to be preferred to new ones." At least, they are cheaper. One notes with regret the perpetuation of the grossly inaccurate fig-